Seasonal changes in feed quality of *Dorycnium* spp.

Simon R. Davies[1] and Peter A. Lane[1]

[1] School of Agricultural Science/ TIAR, University of Tasmania, Tasmania.
sdavies@utas.edu.au , peter.lane@utas.edu.au

Abstract

Dorycnium spp. are perennial browse legumes that have been identified as having the potential to grow and persist in areas of low rainfall and meet feed shortfalls during summer and autumn, drought or extended dry periods. Established plots of *Dorycnium rectum, D. hirsutum* and *D. pentaphyllum* were sampled on a regular basis along with an area of lucerne (*Medicago sativa*) from September 2001 to April 2002. Samples were dried, ground and analysed using near infra-red spectroscopy (NIRS) and wet chemistry for metabolisable energy, crude protein and digestibility. The three species of *Dorycnium* displayed predictable changes in feed quality throughout the growing season. Crude protein levels ranged from 5-18% of plant dry matter (DM), DM digestibility from 45-67% and metabolisable energy from 6.2-9.6 MJ/kg/DM. The feed value of the forage produced by the *Dorycnium* spp. was lower than that displayed by lucerne. However, it is concluded that the forage produced by *Dorycnium* spp. can provide livestock with a source of nutrition in areas of low rainfall during late summer and autumn where there are regular periods of feed shortage from conventional pastures.

Keywords

Crude protein, digestibility, fibre, energy, NIRS, legumes.

Introduction

Dorycnium spp. are perennial leguminous shrubby plants (1,4,5,8) that have been found to be suited to a range of climatic conditions including, high winds, low winter temperatures and low rainfall (6). Research into the growth of *Dorycnium* spp. in New Zealand has indicated these plants can provide a source of forage on, and revegetate areas subject to dry and low soil fertility conditions (7). *Dorycnium* spp. are being evaluated in Tasmania as a potential source of forage in areas where the average annual rainfall is <500mm.

Anecdotal evidence has shown that *Dorycnium* spp. are palatable to sheep, with stock readily grazing stands of the plants when little or no other feed is available. The feed value of *Dorycnium* spp. is relatively unknown, and is an important consideration in the evaluation of these plants as potential introductions into temperate or Mediterranean grazing systems.

A series of samplings were undertaken of three *Dorycnium* spp. and lucerne during the main growing season of 2001-2002 to determine the seasonal pattern of change, and the relative differences between species in feed value.

Materials and Methods

The site used for this trial was located at Swansea on the East Coast of Tasmania where plots of *D. rectum*, *D. hirsutum* and *D. pentaphyllum* had been established in 1995. The sampling regime started in early spring (September 2001) and continued at monthly intervals through to autumn (April 2002). This was designed to include the predominate growing season of these plants and the summer/ autumn period when they are likely to be grazed by stock.

The trial site consisted of three plots (15m x 10m) of mature *Dorycnium* plants, one of each species. Three plants were chosen at random using random numbers for each species, at each harvest date. A sample of forage comprising the top 30cm of growth was harvested using hand shears. Lucerne, a high

quality forage was included in the sampling program to provide a set of reference data for general comparison with the feed quality characteristics of the *Dorycnium* spp. The paddock of lucerne (*Medicago sativa* L.) cv. Southern Special was an irrigated crop situated on the University Farm (Cambridge) ~80km South of Swansea. Three caged plots were excluded from the rest of the crop for the purpose of sampling.

The harvested plant material was dried at 70?C to a constant weight in a forced draught oven. The dried plant material was ground to <1mm and sent to `Feedtest' laboratories (Hamilton, Victoria) for analysis using NIRS and wet chemistry. The analysis determined crude protein and digestibility as a percentage of the dry matter (DM), and metabolisable energy as MJ/kg/DM.

Results and Discussion

The results obtained from this research have shown the changes in feed characteristics for the three species of *Dorycnium* when examined over the main growing season of September 2001 through April 2002.

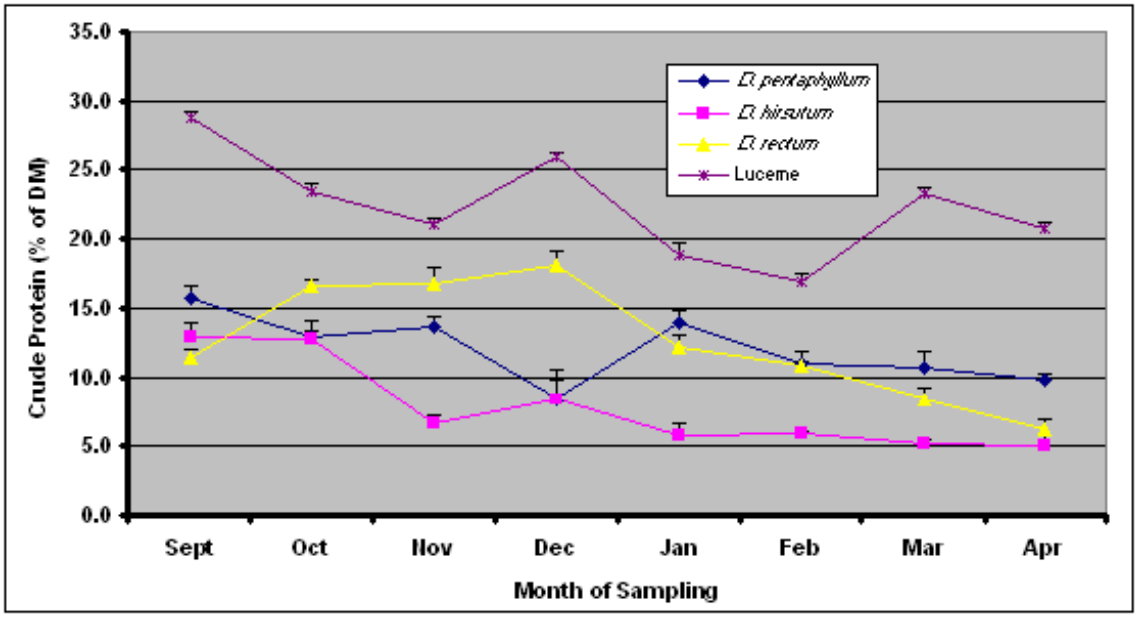

Figure 1: Change in crude protein content of *Dorycnium* spp. and lucerne. Error bars display the standard error.

There was an overall decrease in crude protein (CP) content for all species from the start of the growing season to the end (Figure 1). The CP content of lucerne was greater at all sampling times, however, the CP levels for the *Dorycnium* spp. were considered to be adequate for the maintenance or low levels of stock production.

The CP content of *D. rectum* increased initially up until December and then declined. The increase in the CP during October and November corresponded to abnormal rainfall events, which more than doubled the long-term average for these two months. This accounts for the flush of fresh growth observed with *D. rectum*. *D. pentaphyllum* displayed a sudden decrease in CP in December and then increased again before declining steadily over time. *D. hirsutum* also displayed a decrease in CP over time with a slight increase during December. The increase in CP during December-January for *D. pentaphyllum* and *D. hirsutum* appeared to be due to a combination of rainfall and stage of plant development.

The decline in the CP content of all of the *Dorycnium* spp. occurred at about the time of flower initiation and continued to decline throughout the sampling period. However, *D. pentaphyllum* increased in CP during the January period, which coincided with the initiation of vegetative growth again following flowering. The initiation of flowering for *D. pentaphyllum, D. rectum* and *D. hirsutum* occurred during November, January and October respectively. Minson (1990) indicated that with maturing forage there is an increase in the proportion of leaf and flowering stem coinciding with a decrease in CP content of the plant.

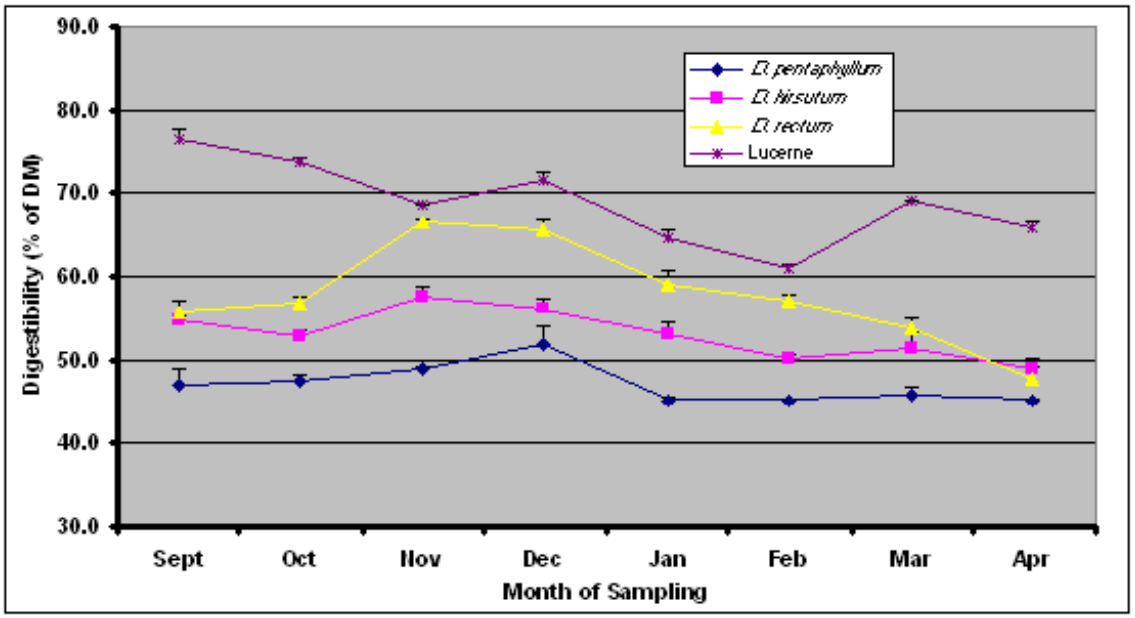

Figure 2: Change in dry matter digestibility of *Dorycnium* spp. and lucerne. Error bars display standard errors.

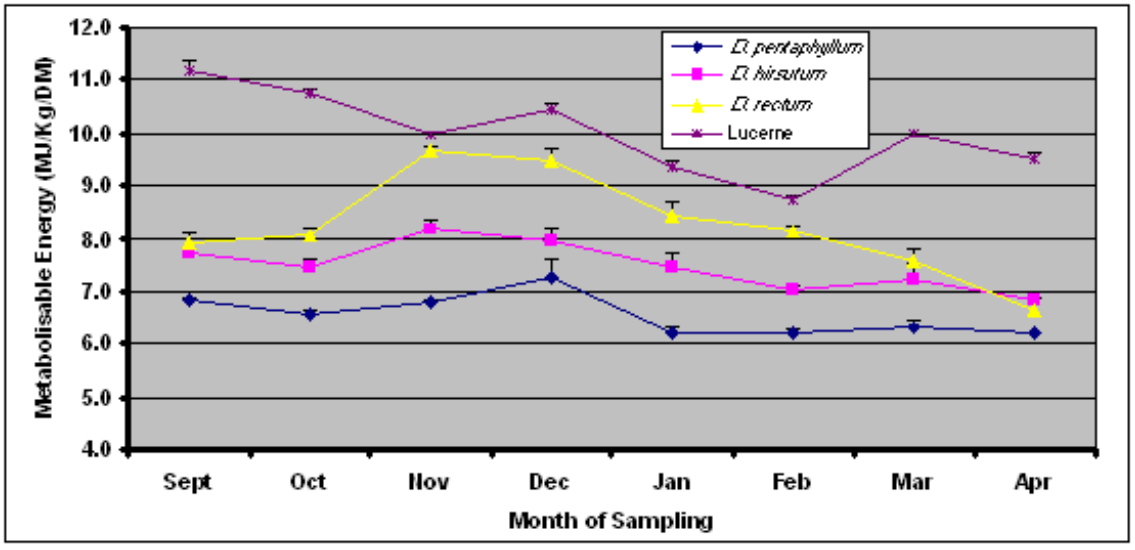

Figure 3: Change in metabolisable energy of *Dorycnium* spp. and lucerne. Error bars display standard errors.

The metabolisable energy (ME) of the samples was determined from the digestibility using the equation: ME = 0.168[{(0.95DMD) - 0.9} + EE] - 1.19, where DMD = dry matter digestibility and EE = fat (assumed to be 2 for pasture) (Dalton, pers. comm., 2002), and therefore trends are very similar. There was a slight overall decline in DMD and ME from the beginning of the sampling in September until the final sampling in April. DMD and ME of *D. rectum* and *D. hirsutum* peaked during November, whereas *D. pentaphyllum* peaked during December. The *Dorycnium* spp. generally had lower DMD and ME than lucerne, although *D. rectum* had very similar levels at the time of harvest in November.

The peak in DMD and ME for all of the *Dorycnium* spp. was during the November-December period, which followed the high rainfall periods during October-November. The peak and then decline in DMD and ME for the *Dorycnium* spp. also corresponded to the initiation of flowering. The peak and decline in digestibility and metabolisable energy for the *Dorycnium* spp. appeared to be influenced by the high rainfall events during the October-November periods and the change in plant development from vegetative to reproductive growth. Minson (1990) indicated that the decrease in dry matter digestibility of forage is associated with the increase in proportion of leaf sheath, stem, flowering head, cellulose, hemicellulose and lignin. In addition to this the decrease in CP content also decreases digestibility and hence, metabolisable energy.

Lucerne was included in this evaluation of *Dorycnium* spp. to provide a source of reference as a leguminous forage plant considered to be of high nutritional value. Overall *Dorycnium* spp. displayed lower levels of nutrition in terms of CP, DMD and ME than lucerne. Douglas and Foote (1994) investigated the DM production of a range of perennial species including, lucerne, *D. hirsutum, D. pentaphyllum* and *D. rectum.* These plants were grown on a site considered to be subject to moisture stress on the North Island of New Zealand. The DM production for these four species was 1.02, 3.73, 0.31 and 3.83 t DM/ ha respectively. These production figures indicate that despite the apparent lower forage quality of *Dorycnium* spp. forage, their DM production compared with lucerne could more than compensate to provide stock with an important source of nutrition.

The data collected indicates that *Dorycnium* spp. can provide a valuable source of nutrition to grazing animals. Although the quality of the feed produced is lower than some other forage crops, the inherent characteristics of *Dorycnium* spp. means that this production can occur under adverse conditions i.e low rainfall periods. This is where *Dorycnium* spp. has the potential to be included in grazing systems as a late season or reserve of forage when feed gaps occur and help maintain stock condition and/ or reduce losses in animal production.

Conclusions

Dorycnium spp. are a potential source of forage for grazing animals. Whilst the feed quality of the plants analysed was lower than that of lucerne sampled during the same growing season, the inherent ability of *Dorycnium* spp. to produce feed during periods of low rainfall indicates that these plants are potentially valuable sources of feed. Changes in feed quality characteristics were broadly correlated to plant development and environmental factors. *D. rectum* appeared to be the best source of plant nutrition of the *Dorycnium* spp. examined.

Acknowledgements

We gratefully acknowledge the excellent technical support provided by Mr Eric Hall, and RIRDC for funding this project. Also, we would like to thank Suzanne Dalton (Feedtest, Hamilton, Victoria) for information relating to NIRS analysis of plant samples.

References

(1) Allen, O.N., and Allen, E.K., (1981), The Leguminosae. A source book of characteristics, uses and nodulation, Univ. of Wisconsin Press.

(2) Douglas, G.B., and Foote, A.G., (1994), Establishment of perennial species useful for soil conservation and as forages, *New Zealand Journal of Agricultural Research*, Vol. 37: 1-9.

(3) Minson, D.J., (1990), Forage in Ruminant Nutrition, Academic Press, INC., Sydney.

(4) Rys, G.J., Smith, N., and Slay, M.W., (1988), Alternative forage species for Hawkes Bay, *Agronomy Society of New Zealand*, **18:**75-80.

(5) Wills, B.J., (1983), Forage plants for the semi and high country and rangelands of New Zealand. *In: Proceedings of the 1983 Hill and High Country Seminar*, Lincoln College, Centre for Resource Management, Special Publication 26. Pp 59-65.

(6) Wills, B.J., and Douglas, G.B., (1984), Canary Clovers, Streamland 32, National Water and Soil Conservation Authority Publication. 4.

(7) Wills, B.J., Begg, J.S.C., and Foote, A.G., (1989), *Dorycnium* species – Two new legumes with potential for dryland pasture rejuvenation and resource conservation in New Zealand, *Proceedings of the New Zealand Grassland Association*, **50:** 169-174.

(8) Wills, B.J., (1994), Alternative plant species for revegetation and soil conservation in the tussock grasslands of New Zealand, *J. Tussock Grassl. Mountain Lands Inst. Rev.*, **42**, 49-58.